

REMARKS

Favorable reconsideration of this application, in view of the present amendment and in light of the following discussion, is respectfully requested.

Claims 33, 34, 37-42, 44 and 47-57 are pending, with claims 33, 38, 42 and 51 amended, and claim 43 cancelled without prejudice or disclaimer by the present application. Claims 33, 42 and 51 are independent.

In the Official Action, claim 38 was rejected under 35 U.S.C. § 112, first paragraph; claims 42-44, 47-50 and 55-57 were rejected under 35 U.S.C. § 112, second paragraph; and claims 33-34, 37-44 and 47-57 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Tanizawa (U.S. Patent Pub. No. 2003/0205711) in view of Vaudo (U.S. Patent No. 6,440,823).

Claims 33, 38, 42 and 51 are amended to more clearly describe and distinctly claim Applicant's invention. Support for this amendment is found in Applicant's originally filed specification. No new matter was added.

Applicant submits that the rejections under 35 U.S.C. § 112, first and second paragraph, are moot in view of the current amendment.

Briefly recapitulating, amended claim 33 is directed to:

A light emitting diode (LED), comprising:

a first gallium nitride layer having a first conductivity;

a super lattice structure including InGaN on the first gallium nitride layer,

wherein the super lattice structure includes a plurality of first InGaN layers and a plurality of second InGaN layers,

wherein each of the plurality of first InGaN layers has an In composition different from an In composition of each of the plurality of second InGaN layers, and

wherein one of the plurality of first InGaN layers or one of the plurality of second InGaN layers is directly on the first gallium nitride layer;

an active layer on the super lattice structure including InGaN; and

a second gallium nitride layer having a second conductivity on the active layer,

wherein the super lattice structure including InGaN has a plurality of pits formed thereon, and

wherein a non-zero number of the plurality of pits is 50 or less per area of $5\mu\text{m}\times 5\mu\text{m}$.

Tanizawa describes an N-type nitride semiconductor laminate that includes: a substrate; a buffer layer made of $\text{Al}_a\text{Ga}_{1-a}\text{N}$ ($0.05 \leq a \leq 0.8$) which is formed on a surface of the substrate; and an n-side nitride semiconductor layer which is formed on the buffer layer.

Cited Fig. 1 of Tanizawa includes a substrate 1 having, on a top surface, a set of layers deposited successively in this order: a buffer layer 2, an undoped $\text{Al}_a\text{Ga}_{1-a}\text{N}$ layer 3, an n-type contact layer 4 containing an n-type impurity, an n-side first multi-layered film 5, an n-side second multi-layered film 6, an active layer 7 of a multiple quantum-well structure, a p-type cladding layer 8 in the form of a superlattice structure, and a p-type contact layer 10 containing a p-type impurity. There is also an n-electrode 12 on the n-type contact layer 4 and a p-electrode 11 on the p-type contact layer 10.

The Official Action asserts that Tanizawa's second multi-layered film 6 on n-type contact layer 4 is equivalent to Applicant's claimed super lattice structure including InGaN on the first gallium nitride layer. Applicant traverses, and notes that Tanizawa's second multi-layered film 6 does not include a plurality of first InGaN layers and a plurality of second InGaN layers, where

one of the plurality of first InGaN layers or one of the plurality of second InGaN layers is directly on the first gallium nitride layer. Instead, Tanizawa's second multi-layered film 6 is directly on n-side first multi-layered film 5. Thus, for a first reason, amended independent claim 33 patentably defines over Tanizawa.

Furthermore, when Tanizawa's n-side second multi-layered film 6 is formed between the buffer layer 2 and the active layer 7, a number of pits occurring in each nitride semiconductor layer (of n-side second multi-layered film 6) can be decreased and the surface morphology can be improved to relax inner strain. However, as acknowledged by the Official Action, Tanizawa's n-side second multi-layered film 6 does not include a non-zero number of pits, where the non-zero number is 50 or less per area of $5\mu\text{m}\times 5\mu\text{m}$. To cure this deficiency, the Official Action applies Vaudo.

Vaudo describes a method of forming a GaN material, comprising growing the GaN material by a hydride vapor phase epitaxy (HVPE) growth process using NH_3 , HCl and Ga as reactants. The HVPE growth process is carried out at a temperature in the range of from about 985°C to about 1010°C , at a specified growth rate, at a pressure of from about 10 to about 800 torr, and with a NH_3/HCl ratio of from about 20 to about 40, so that the formed GaN material includes dislocations that are predominantly angled with respect to the growth direction by a tilt angle that is in the range of 0.1 to about 40. The resultant GaN material has a predetermined dislocation defect density.

In Vaudo, the HVPE growth of GaN leads to undesirable pit formation. However, Vaudo's low temperature (low surface mobility) nucleation achieves low defect density. By combining low temperature nucleation with the subsequent high temperature surface smoothing

growth, Vaudo provides dislocation densities less than $5 \times 10^6 \text{ cm}^{-2}$ and pit densities less than 50 cm^{-2} .

However, the hydride vapor phase epitaxy (HVPE)/ low temperature nucleation techniques of Vaudo are used to control the growth of pits on Vaudo's GaN layer over sapphire, and are not used *vis-à-vis* any type of super lattice structure including InGaN. Because Vaudo's technique is not directed to any type of super lattice structure including InGaN, Vaudo does not cure the acknowledged deficiencies of Tanizawa. Thus, for a first reason, Tanizawa and Vaudo, alone or in combination, do not disclose or suggest all of the features of Applicant's claim 33.

Furthermore, it is not even clear how one skilled in the art would apply the GaN layer formation techniques of Vaudo (i.e., hydride vapor phase epitaxy (HVPE)/ low temperature nucleation) to Tanizawa's lamination of n-side second multi-layered film 6. As noted in MPEP 2143.01, if proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). Here, Applicant submits that Vaudo's hydride vapor phase epitaxy (HVPE)/ low temperature nucleation process would render Tanizawa's n-side second multi-layered film 6 unsuitable for any purpose. Thus, for a second reason, Tanizawa and Vaudo, alone or in combination, do not disclose or suggest all of the features of Applicant's claim 33.

Furthermore, in *KSR v. Teleflex* (127 S. Ct. 1727, 1740 (2007)), the Court noted that "[u]nder the correct analysis, any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." The Court also noted that "a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated

success, it is likely the product not of innovation but of ordinary skill and common sense. In that instance the fact that a combination was obvious to try might show that it was obvious under §103.” However, the Court went on to note that “rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.”

Here, however, the Official Action fails to provide a rational reason, due to either a misunderstanding of the invention/references or hindsight reasoning, for combine the techniques of Vaudo with the device of Tanizawa. That is, there is no rational reason to replace or augment the lamination process of Tanizawa (see ¶ 0059) with the hydride vapor phase epitaxy (HVPE)/low temperature nucleation process of Vaudo. Thus, for a third reason, Tanizawa and Vaudo, alone or in combination, do not disclose or suggest all of the features of Applicant’s claim 33.

Furthermore, like Tanizawa, Vaudo does not disclose or suggest Applicant’s claimed plurality of first and second InGa_N layers, where one of the plurality of first InGa_N layers or one of the plurality of second InGa_N layers is directly on the first gallium nitride layer. Thus, for a fourth reason, Tanizawa and Vaudo, alone or in combination, do not disclose or suggest all of the features of Applicant’s claim 33.

Applicant submits that amended independent claims 42 and 51 patentably define over the applied references for reasons similar to those presented above relative to amended independent claim 33.

As none of the cited art, individually or in combination, disclose or suggest at least the above-noted features of independent claims 33, 42 and 51, Applicant submits the inventions defined by claims 33, 42 and 51, and all claims depending therefrom, are not rendered obvious by the asserted references for at least the reasons stated above.

MPEP 2141 notes that prior art is not limited just to the references being applied, but includes the understanding of one of ordinary skill in the art. MPEP 2141 further notes that the prior art reference (or references when combined) need not teach or suggest all the claim limitations. However, an obviousness-type rejection must explain why the difference(s) between the prior art and the claimed invention would have been obvious to one of ordinary skill in the art. MPEP 2141 goes on to list exemplary rationales that may support a conclusion of obviousness. However, Applicant submits that the Official Action and the applied references present no objective evidence that would support an obviousness-type rejection of Applicant's amended claims based on one of these exemplary rationales.

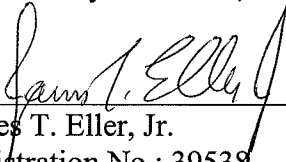
CONCLUSION

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Michael E. Monaco, Reg. No. 52,041, at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§ 1.16 or 1.147; particularly, extension of time fees.

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Respectfully submitted,

By  _____

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